

*Please provide the following information, and submit to the NOAA DM Plan Repository.*

**Reference to Master DM Plan (if applicable)**

*As stated in Section IV, Requirement 1.3, DM Plans may be hierarchical. If this DM Plan inherits provisions from a higher-level DM Plan already submitted to the Repository, then this more-specific Plan only needs to provide information that differs from what was provided in the Master DM Plan.*

URL of higher-level DM Plan (if any) as submitted to DM Plan Repository:

**1. General Description of Data to be Managed****1.1. Name of the Data, data collection Project, or data-producing Program:**

2012 FEMA Risk Map Lidar: Merrimack River Watershed (Massachusetts, New Hampshire)

**1.2. Summary description of the data:**

These data are the lidar points collected for FEMA Risk Mapping, Assessment, and Planning (Risk MAP) for the Merrimack River Watershed.

This area falls in portions of Hillsborough, Belknap, Merrimack, Rockingham and Strafford counties in New Hampshire and portions of

Essex, Middlesex and Worcester counties in Massachusetts.

Using a Leica ALS60 LiDAR system, a total of 268 flight lines of high density (Nominal Pulse Spacing of 1.0 m) were collected over the Merrimack

area which encompasses 1302 square miles. A total of 19 separate lifts were flown on November 11th, 12th and 13th and December 19th and 29th,

2011 and January 7th and 11th in 2012. One airborne global positioning system (GPS) base station was used to support the LiDAR data

acquisition: FIT B.

The data were received by the NOAA Office for Coastal Management from NH GRANIT. For data storage and Digital Coast provisioning purposes

the data were:

1. Converted from UTM Zone 19, meters, NAD83 to geographic coordinates.
2. Converted from NAVD88 (Geoid09), meters to ellipsoid heights, using Geoid09
3. Converted overlap points that were classified as 11 to class 12 (Overlap).

Data available for download from the Digital Coast include the following classifications:

1. (Unclassified)

2. (Ground)

7. (Low Point Noise)

9. (Water)

10. (Ignored)

16. (Withheld for ASPRS Definition, original data classed as 11, moved due to Digital Class use of class 11)

17. (USGS Overlap Default)

18. (USGS Overlap Ground)

Original contact information:

Contact Org: NH GRANIT

Phone: 603-862-1792

Email: granit@unh.edu

**1.3. Is this a one-time data collection, or an ongoing series of measurements?**

One-time data collection

**1.4. Actual or planned temporal coverage of the data:**

2011-11-11 to 2012-01-11

**1.5. Actual or planned geographic coverage of the data:**

W: -71.973079, E: -71.083734, N: 42.53304, S: 42.448337

**1.6. Type(s) of data:**

*(e.g., digital numeric data, imagery, photographs, video, audio, database, tabular data, etc.)*  
las

**1.7. Data collection method(s):**

*(e.g., satellite, airplane, unmanned aerial system, radar, weather station, moored buoy, research vessel, autonomous underwater vehicle, animal tagging, manual surveys, enforcement activities, numerical model, etc.)*

**1.8. If data are from a NOAA Observing System of Record, indicate name of system:**

**1.8.1. If data are from another observing system, please specify:**

**2. Point of Contact for this Data Management Plan (author or maintainer)**

**2.1. Name:**

NOAA Office for Coastal Management (NOAA/OCM)

**2.2. Title:**

Metadata Contact

**2.3. Affiliation or facility:**

NOAA Office for Coastal Management (NOAA/OCM)

**2.4. E-mail address:**

coastal.info@noaa.gov

**2.5. Phone number:**

(843) 740-1202

**3. Responsible Party for Data Management**

*Program Managers, or their designee, shall be responsible for assuring the proper management of the data produced by their Program. Please indicate the responsible party below.*

**3.1. Name:****3.2. Title:**

Data Steward

**4. Resources**

*Programs must identify resources within their own budget for managing the data they produce.*

**4.1. Have resources for management of these data been identified?****4.2. Approximate percentage of the budget for these data devoted to data management (specify percentage or "unknown"):****5. Data Lineage and Quality**

*NOAA has issued Information Quality Guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information which it disseminates.*

**5.1. Processing workflow of the data from collection or acquisition to making it publicly accessible**

*(describe or provide URL of description):*

Process Steps:

- 2012-01-01 00:00:00 - GPS based surveys were utilized to support both processing and testing of LiDAR data within FEMA designated Areas of Interest (AOIs).

Geographically distinct ground points were surveyed using GPS technology throughout the AOI to provide support for three distinct tasks. Task 1 was to provide Vertical Ground Control to support the aerial acquisition and subsequent bare earth model processing. To accomplish this, survey-grade Trimble R-8 GPS receivers were used to collect a series of control points located on open areas, free of excessive or significant slope, and at least 5 meters away from any significant

terrain break. Most if not all control points were collected at street/road intersections on bare level pavement. Task 2 was to collect Fundamental Vertical Accuracy (FVA) checkpoints to evaluate the initial quality of the collected point cloud and to ensure that the collected data was satisfactory for further processing to meet FEMA specifications. The FVA points were collected in identical fashion to the Vertical Ground Control Points, but segregated from the point pool to ensure independent quality testing without prior knowledge of FVA locations by the aerial vendor. Task 3 was to collect Consolidated Vertical Accuracy (CVA) checkpoints to allow vertical testing of the bare-earth processed LiDAR data in different classes of land cover, including: Open (pavement, open dirt, short grass), High Grass and Crops, Forest, Urban. CVA points were collected in similar fashion as Control and FVA points with emphasis on establishing point locations within the predominant land cover classes within each AOI or Functional AOI Group. In order to successfully collect the Forest land cover class, it was necessary to establish a Backsight and Initial Point with the R8 receiver, and then employ a Nikon Total Station to observe a retroreflective prism stationed under tree canopy. This was necessary due to the reduced GPS performance and degradation of signal under tree canopy. The R-8 receivers were equipped with cellular modems to receive real-time correction signals from the Keystone Precision Virtual Reference Station (VRS) network encompassing the Region 1 AOIs. Use of the VRS network allowed rapid collection times (~3 minutes/point) at 2.54 cm (1 inch) initial accuracy. All points collected were below the 8cm specification for testing 24cm, Highest category LiDAR data. To ensure valid in-field collections, an NGS monument with suitable vertical reporting was measured using the same equipment and procedures used for Control, FVA and CVA points on a daily basis. The measurement was compared to the NGS published values to ensure that the GPS collection schema was producing valid data and as a physical proof point of quality of collection.

- 2012-01-01 00:00:00 - Those monument measurements are summarized in the Accuracy report included in the data deliverables. 20 FVA points are necessary to allow testing to CE95. 1 point out of 20 may fail vertical testing and still allow the entire dataset to meet 95% accuracy requirements. In similar fashion, 76 CVA points are necessary to test to CE95 as discussed above. 72 CVA points were collected with the intention at the outset that 4 of the collected FVAs would perform double, duty as Open-class CVA points, to total 76 CVAs. The following software packages and utilities were used to control the GPS receiver in the field during data collection, and then ingest and export the collected GPS data for all points: Trimble Survey Controller, Trimble Pathfinder Office. The following software utilities were used to translate the collected Latitude/Longitude Decimal Degree HAE GPS data for all points into Latitude/Longitude Degrees/Minutes/Seconds for checking the collected monument data against the published NGS Datasheet Lat/Long DMS values and into UTM NAD83 Northings/Eastings: U.S. Army Corps of Engineers CorpsCon, National Geodetic Survey Geoid09NAVD88. MSL values were determined using the most recent NGS-approved geoid model to generate geoid separation values for each Lat/Long coordinate pair. In this fashion, Orthometric heights were determined for

each Control, FVA and CVA point by subtracting the generated Geoid Separation value from the Ellipsoidal Height (HAE) for publication and use as MSL NAVD88(09).

Using a Leica ALS60 LiDAR system, 268 flight lines of highest density (Nominal Pulse Spacing of 1.0m) were collected over the Merrimack area which encompasses 1302 square miles. Five (5) blocks (block or area is determined by the Base Station control locations, typically airports with ground control monuments available providing coverage within 18 miles of the base as possible) to cover in its entirety.

Area | Flight Lines | Lifts | Dates | System CON | 79 | 7 | 12/19-12/29 2011 |  
 ALS60 ASH | 64 | 5 | 1/7-1/11 2012 | ALS60 BED | 31 | 1 | 1/11/2012 | ALS60  
 LCI | 34 | 2 | 11/12-11/13 2011 | ALS60 AFN | 48 | 4 | 11/12-11/13 2011 | ALS60  
 Cross Flights 12 Flight Lines...Lifts were combined with the acquisition of each area with both sensors

- 2012-01-01 00:00:00 - Leica proprietary software was used in the post-processing of the airborne GPS and inertial data that is critical to the positioning and orientation of the sensor during all flights. Pairing the aircraft's raw trajectory data with the stationary GPS base station data, this software yields Leica IPAS TC (Inertial Positioning & Attitude Sensor Tightly Coupled) smoothed best estimate of trajectory (an SBET, in Leica's .sol file format) that is necessary for Leica's ALSPP post processing software to develop the resulting geo-referenced point cloud from the LiDAR missions. The point cloud is the mathematical three dimensional composite of all returns from all laser pulses as determined from the aerial mission. At this point this data is ready for analysis, classification, and filtering to generate a bare earth surface model in which the above-ground features are removed from the data set. The point cloud was created using Leica Post Processor software. GeoCue was used in the creation of some of the files needed in downstream processing, as well as in the tiling of the dataset into more manageable file sizes. The TerraScan and TerraModeler software packages are then used for the automated data classification, manual cleanup, and bare earth generation from this data. Project specific macros were used to classify the ground and to remove the side overlap between parallel flight lines. All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. QT Modeler was used as a final check of the bare earth dataset. GeoCue was then used to create the deliverable industry-standard LAS files for both the All Point Cloud Data and the Bare Earth. In-house software was then used to perform final statistical analysis of the classes in the LAS files. Point Cloud data is manually reviewed and any remaining artifacts are removed using functionality provided within the TerraScan and TerraModeler software packages. Additional project specific macros are created and run within GeoCue/TerraScan to ensure correct LAS classification prior to project delivery. Final Classified LAS tiles are created within GeoCue to confirm correct LAS versioning and header information. In-house software is then used to check LAS header information and final LAS classification prior to delivery. LAS Class 2 is used to check the independent QC points against the Triangulated LiDAR surface.

- 2012-01-01 00:00:00 - 1-Convert LAS to Multipoint 2-Create Terrain 3-Convert

Terrain to 1m Raster 4-Split 1m Raster into 1749 imagine files 5-Contour Convert LAS to multipoint: 1. Create file geodatabase and create a feature dataset to store terrain information with appropriate projection and spatial domain. 2. Run LAS to multipoint tool in 3D analyst for the classified LAS files and select class 2 and 8. 3. Store results in file geodatabase feature dataset for terrain data. Create Terrain 1. Create Terrain using multipoint as masspoints, hydro break lines as hard breakline and LiDAR coverage area as soft clip 2. Build Terrain and store in file geodatabase feature dataset for terrain data Convert Terrain to 1m Raster 1. Run the Terrain to raster tool in 3D analyst 2. Float output data type, Linear as the method, CELLSIZE 1 as sampling distance, and Pyramid Level Resolution 0 3. Save results as a Geotiff dataset. Split 1m Raster into tiles 1. Load 1m raster into ERDAS Imagine Mosaic pro tool 2. Split raster using LiDAR index 3. Save results as 1m imagine files Create contours 1. Extract by mask from the 1m DEM using a HUC12 area. Save this raster as HUC12 Name 1m. 2. Focal Statistics using Extracted 1m DEM as input, Intermediate Focal Raster as Output, Neighborhood should be set to weighted kernel, and the statistic should be sum. 3. Create contours using focal stats raster as input, output polyline should be based on HUC12 name, Contour Interval of 2ft, Set base contour to DEM minimum z value 4. Check results and store in file geodatabase under the Analysis Contours feature dataset. 5. Focal Statistics using Extracted 1m DEM as input, Intermediate Focal Raster as Output, Neighborhood should be set to circle, and the statistic should be mean. 6. Create contours using focal stats raster as input, output polyline should be based on HUC12 name, Contour Interval of 2ft, Set base contour to DEM minimum z value 7. Check results and store in file geodatabase under the Cartographic Contours feature dataset.

- 2013-07-01 00:00:00 - The NOAA Office for Coastal Management received elevation and intensity data las files in LAS v1.2 format. The data were in UTM Zone 19, meters, NAD83 coordinates and were vertically referenced to NAVD88 (Geoid09). The vertical units of the data were meters. OCM performed the following processing for data storage and Digital Coast provisioning purposes: 1. Data were filtered for outliers using the lastools tool, las2las 2. Data points that were overlap points, but were classified as 11, were converted to class 16 (overlap), using the lastools tool, las2las 3. Data were converted from UTM Zone 19, meters, NAD83 to geographic coordinates. 4. Data were converted from NAVD88 (Geoid09) elevations, to ellipsoid elevations using Geoid09 5. Data were zipped to laz format

**5.1.1. If data at different stages of the workflow, or products derived from these data, are subject to a separate data management plan, provide reference to other plan:**

**5.2. Quality control procedures employed (describe or provide URL of description):**

## 6. Data Documentation

*The EDMC Data Documentation Procedural Directive requires that NOAA data be well documented,*

*specifies the use of ISO 19115 and related standards for documentation of new data, and provides links to resources and tools for metadata creation and validation.*

**6.1. Does metadata comply with EDMC Data Documentation directive?**

No

**6.1.1. If metadata are non-existent or non-compliant, please explain:**

Missing/invalid information:

- 1.7. Data collection method(s)
- 3.1. Responsible Party for Data Management
- 4.1. Have resources for management of these data been identified?
- 4.2. Approximate percentage of the budget for these data devoted to data management
- 5.2. Quality control procedures employed
- 7.1. Do these data comply with the Data Access directive?
- 7.1.1. If data are not available or has limitations, has a Waiver been filed?
- 7.1.2. If there are limitations to data access, describe how data are protected
- 7.4. Approximate delay between data collection and dissemination
- 8.1. Actual or planned long-term data archive location
- 8.3. Approximate delay between data collection and submission to an archive facility
- 8.4. How will the data be protected from accidental or malicious modification or deletion prior to receipt by the archive?

**6.2. Name of organization or facility providing metadata hosting:**

NMFS Office of Science and Technology

**6.2.1. If service is needed for metadata hosting, please indicate:**

**6.3. URL of metadata folder or data catalog, if known:**

<https://www.fisheries.noaa.gov/inport/item/49848>

**6.4. Process for producing and maintaining metadata**

*(describe or provide URL of description):*

Metadata produced and maintained in accordance with the NOAA Data Documentation Procedural Directive: [https://nosc.noaa.gov/EDMC/DAARWG/docs/EDMC\\_PD-Data\\_Documentation\\_v1.pdf](https://nosc.noaa.gov/EDMC/DAARWG/docs/EDMC_PD-Data_Documentation_v1.pdf)

**7. Data Access**

*NAO 212-15 states that access to environmental data may only be restricted when distribution is explicitly limited by law, regulation, policy (such as those applicable to personally identifiable information or protected critical infrastructure information or proprietary trade information) or by security requirements. The EDMC Data Access Procedural Directive contains specific guidance, recommends the use of open-standard, interoperable, non-proprietary web services, provides information about resources and tools to enable data access, and includes a Waiver to be submitted to justify any approach other than full, unrestricted public access.*

**7.1. Do these data comply with the Data Access directive?**

**7.1.1. If the data are not to be made available to the public at all, or with limitations, has a Waiver (Appendix A of Data Access directive) been filed?**

**7.1.2. If there are limitations to public data access, describe how data are protected from unauthorized access or disclosure:**

**7.2. Name of organization of facility providing data access:**

NOAA Office for Coastal Management (NOAA/OCM)

**7.2.1. If data hosting service is needed, please indicate:****7.2.2. URL of data access service, if known:**

<https://coast.noaa.gov/dataviewer/#/lidar/search/where:ID=2516>

[https://coast.noaa.gov/htdata/lidar1\\_z/geoid18/data/2516](https://coast.noaa.gov/htdata/lidar1_z/geoid18/data/2516)

**7.3. Data access methods or services offered:**

This data can be obtained on-line at the following URL:

<https://coast.noaa.gov/dataviewer/#/lidar/search/where:ID=2516>

This data set is dynamically generated based on user-specified parameters.

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**7.4. Approximate delay between data collection and dissemination:**

**7.4.1. If delay is longer than latency of automated processing, indicate under what authority data access is delayed:**

**8. Data Preservation and Protection**

*The NOAA Procedure for Scientific Records Appraisal and Archive Approval describes how to identify, appraise and decide what scientific records are to be preserved in a NOAA archive.*

**8.1. Actual or planned long-term data archive location:**

*(Specify NCEI-MD, NCEI-CO, NCEI-NC, NCEI-MS, World Data Center (WDC) facility, Other, To Be Determined, Unable to Archive, or No Archiving Intended)*

**8.1.1. If World Data Center or Other, specify:**

**8.1.2. If To Be Determined, Unable to Archive or No Archiving Intended, explain:**



**8.2. Data storage facility prior to being sent to an archive facility (if any):**

Office for Coastal Management - Charleston, SC

**8.3. Approximate delay between data collection and submission to an archive facility:**

**8.4. How will the data be protected from accidental or malicious modification or deletion prior to receipt by the archive?**

*Discuss data back-up, disaster recovery/contingency planning, and off-site data storage relevant to the data collection*

**9. Additional Line Office or Staff Office Questions**

*Line and Staff Offices may extend this template by inserting additional questions in this section.*